

What is claimed is:

1. A process for preparing an olefin polymerization catalyst comprising sequentially mixing:

(i) a solution of a mixture of a compound of the formula $(R^1)_2Mg$ where in R^1 is selected from the group consisting of C_{1-6} alkyl radicals and a compound of the formula $Al^1(R^2)_3$ wherein R^2 is selected from the group consisting of C_{1-6} alkyl radicals; with

(ii) a solution of HCl or an organic chloride of the formula R^3Cl wherein R^3 is selected from the group consisting of C_{1-6} alkyl radicals and C_{6-12} aromatic radicals; and maintaining the resulting mixture at a temperature from $25^\circ C$ to $80^\circ C$ for a period from 5 seconds to 1 minute; then

(iii) rapidly adding a solution of a titanium compound of the formula $(R^4)_aTiCl_{b-a}$ wherein R^4 is a C_{1-6} alkoxy radical and a and b are 0 or integers from 1 to 4 and the sum of $a+b$ is 4 to provide a molar ratio of $Mg:Al^1$ from 3:1 to 8:1; a molar ratio of $Cl:Mg$ from 1.5:1 to 2.5:1; molar ratio of $Al^1:Ti$ from 0.5 and in less than 20 seconds bringing temperature of the resulting mixture to from $120^\circ C$ to $180^\circ C$ by any of: 1 to 1.5:1; and a molar ratio of $Mg:Ti$ from 3:1 to 8:1;

a) heating one or more of the mixture of step (ii) and the solution of the titanium compound or both to a temperature sufficient so that upon mixing said temperature is obtained within 20 seconds; or

b) mixing the mixture of step (ii) and the solution of the titanium compound or both either or both of said solutions may optionally be heated

to a temperature insufficient so that upon mixing said temperature is not obtained and heating the resulting mixture at a rate to obtain said temperature within 20 seconds;

and combining the resulting hot mixture with

(iv) a compound of the formula $(R^5)_2Al^2(R^6)$ wherein R^5 is a C_{1-6} alkyl radical and R^6 is a C_{1-6} alkoxy radical to provide a molar ratio of Al^2 to Ti from 0.5:1 to 1.5:1.

2. The process according to claim 1, wherein step (iii) (a) is used.

3. The process according to claim 2, wherein one or more of the mixture of step (ii) and the solution of titanium compound are heated to a temperature from 120°C to 300°C.

4. A process according to claim 3, wherein in step (ii) the halide is an organic halide.

5. The process according to claim 4, wherein R^1 , R^2 and R^3 are selected from the group consisting of C_{1-4} alkyl radicals.

6. The process according to claim 5, wherein R^5 is selected from the group consisting of C_{1-4} alkyl radicals and R^4 and R^6 are selected from the group consisting of C_{1-4} alkoxy radicals.

7. The process according to claim 6, wherein the mixture of components (i) and (ii) are held at a temperature from 30°C to 40°C prior to adding component (iii).

8. The process according to claim 7, wherein the hold up time before adding component (iii) is from 10 seconds to 40 seconds.

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9. The process according to claim 8, wherein in step (iii) the temperature the mixture of component (i), (ii) and (iii) is from 130°C to 160°C.

10. The process according to claim 9, wherein in step (iii) the hold up time of the mixture of component (i), (ii) and (iii) is less than 10 seconds.

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11. The process according to claim 10, wherein a is 0.

12. The process according to claim 11, wherein R¹ is selected from the group consisting of ethyl and butyl radicals.

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13. The process according to claim 12, wherein in step (ii) the halide is t-butyl halide.

14. The process according to claim 13, wherein all R² radicals are methyl radical.

15. The process according to claim 14, wherein R⁵ is an ethyl radical and R⁶ is an ethoxide radical.

16. The process according to claim 15, wherein the molar ratio of Mg:Al¹ is from 4:1 to 6:1.

10 17. The process according to claim 16, wherein the molar ratio of Cl:Mg is from 1.8:1 to 2.2:1.

18. The process according to claim 17, wherein the molar ratio of Al¹:Ti is from 0.8:1 to 1.5:1.

20 19. The process according to claim 18, wherein the molar ratio of Mg:Ti is from 4:1 to 6:1.

20. The process according to claim 19, wherein the molar ratio of Al² to Ti is from 1:1 to 1:1.5.

21. The process according to claim 1, wherein step (iii) (a) is used.

30 22. A process for the solution polymerization of from 80 to 100% of ethylene and from 0 to 20 weight % of one or more C₃₋₈ alpha olefins at a temperature from 120°C to 200°C in the presence of a catalyst prepared according to claim 1.